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## **Production and comprehension of pronouns and reflexives in atypical populations**

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### **Abstract**

The production and comprehension of pronouns and reflexives has been extensively studied in typically-developing children, but has received less attention in children with neurodevelopmental disorders in which language impairment is the primary or secondary deficit, such as in children with specific language impairment, autism spectrum disorders, Williams syndrome and Down syndrome. Research on the acquisition of these core grammatical structures by atypical populations is important for understanding the linguistic nature of the disorders. The present chapter provides a review of experimental studies on the production and comprehension of these structures in different groups of atypical child and adolescent populations from a cross-linguistic perspective. The purpose of the chapter is to unravel similarities and differences between the affected and unaffected groups, and to investigate patterns of delayed and/or deviant performance across modalities and populations.

**Keywords:** pronouns, reflexives, clitics, language impairment, developmental disorders

## 1. Introduction

Language impairment occurs in a variety of neurodevelopmental disorders, such as Williams syndrome (WS), Down syndrome (DS), autism spectrum disorders (ASD) and specific language impairment (SLI), which are characterised by different genetic and neurocognitive mechanisms (Bellugi, Lichtenberger, Jones, Lai, & St. George, 2000; Kemper, 1998; Rice, Warren, & Betz, 2005; Tager-Flusberg, 1999). Even though recent studies have provided precise information regarding the genetic etiologies of some these disorders (Smith & Morris, 2005), the exact relationship between the different clinical conditions and the behavioural manifestations of language impairment remains less clear (Rice et al., 2005). In this respect, the examination of the commonalities and differences across clinical conditions can help us clarify the nature of language impairment in the different disorders and unravel their linguistic underpinnings. It can also highlight which areas of language are vulnerable and which are spared in the context of atypical development.

Furthermore, the examination of language impairment across disorders contributes to the on-going debate regarding the nature of the language faculty and its relation with general cognition (e.g., Fodor, 1983; but see Tomasello, 2003, for a different view on the relationship between language and cognition). Given the extent to which the language faculty is independent from cognition, it should be possible to find dissociations between general cognitive abilities and language skills. For example, relatively preserved language abilities in the context of intellectual disorders are manifested in individuals with WS, whose verbal abilities exceed their performance IQ (Bellugi et al., 2000). At the same time, compromised language abilities are observed in the context of unaffected cognitive development, and SLI is the most typical example of this disparity (Leonard, 1997; Rice & Wexler, 1996).

Additionally, following recent assumptions regarding the architecture of the language faculty (e.g., Chomsky, 1995), the computational system and its core syntactic operations are held to be independent from other language components such as phonology, semantics, or pragmatics. If we assume that the different language components can perform in a rather independent fashion, it should be possible to find dissociations between different language components in the context of atypical language development as well, or to find selective deficiencies within particular grammatical components.

In this respect, the examination of anaphoric expressions such as pronouns and reflexives provides a fruitful ground for addressing questions related to the nature of the linguistic phenotypes of different disorders, as well as to the relative vulnerability of the different components of the language faculty in the context of atypical development.

Pronouns and reflexives are grammatical elements whose realisation and distribution differ cross-linguistically and which lie at the interface of different grammatical domains, including phonology, morpho-syntax, semantics and pragmatics. For example, English has a distinction between strong and reflexive pronouns, as in (1c), Greek between strong, clitic and reflexive pronouns, as in (1a), and French between strong pronouns (STR), on the one hand, and reflexive (REFL) and accusative clitic (CL) pronouns, on the other, as in (1b).<sup>1</sup>

- (1) a. O Petros ton htenizi / htenizi afton / ton eafto tu.  
       Peter him.CL combs / combs him.STR / the.ART self.REFL his.POSS
- b. Pierre le / se peigne / peigne lui.  
       Peter him.CL / himself.CL combs / combs him.STR
- c. Peter combs him (STR) / himself (REFL).

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<sup>1</sup> Greek and French distinguish between direct (accusative) and indirect (dative for French, genitive for Greek) object clitics. French also has subject (nominative) clitics. Here, we focus only on direct object (accusative) clitics and on reflexive clitics (for French only).

The rules that regulate the interpretation of reflexives and pronouns are specified in what is known as Binding Theory (Chomsky, 1981), and involve the interaction of both syntactic and extrasyntactic modules (Grodzinsky & Reinhart, 1993). For example, in (2a) the reflexive *herself* can only refer to *Mama Bear*, which is the local antecedent that c-commands the reflexive, whereas in (2b) the pronoun cannot refer to a local antecedent, the referential noun phrase (NP) (*Mama Bear*). It can only refer to Goldilocks or to an extra-sentential discourse antecedent.

- (2) a. Goldilocks<sub>i</sub> said that Mama Bear<sub>j</sub> is washing herself<sub>\*i/j</sub>.  
 b. Goldilocks<sub>i</sub> said that Mama Bear<sub>j</sub> is washing her<sub>i/h/\*j</sub>.

This distinct pattern of performance has been shown to reflect two different principles of Binding Theory (Chomsky, 1981): Principle A, according to which reflexives must be bound by a local antecedent, and Principle B, which dictates that pronouns need to be free (not bound) within their local domain.

Given that Binding is considered a core grammatical property, it is important to establish whether children with neurodevelopmental disorders also adhere to these grammatical rules, exhibiting a similar but delayed pattern of acquisition compared to what has been reported for typically-developing (TD) children (see Thornton & Wexler, 1999, for an overview), or whether they have a deviant performance not found in typical development.

To address the above-mentioned issues, this chapter sets out to evaluate current experimental studies on the production and interpretation of referential expressions in atypical populations. Given that the performance on the production and comprehension of pronouns and reflexives has been shown to vary across languages depending on specific

target-language properties (e.g., Baauw & Cuetos, 2003), we adopt a cross-linguistic perspective. We focus on languages where at least two different populations with language disorders have been investigated. The chapter is organised as follows. Section 2 briefly reviews studies with TD children on the acquisition of reflexives and pronouns. Section 3 investigates the acquisition of pronouns and reflexives in children and adolescents with different neurodevelopmental language disorders, such as SLI, ASD, WS and DS. We review the literature in search of qualitative and quantitative differences between typical and atypical populations. The following two sections examine in more detail two areas that have been shown to be problematic in atypical populations, namely the production of clitic pronouns (Section 4) and binding (Section 5). We conclude with general remarks and future directions.

## **2. Acquisition of pronouns and reflexives in typically-developing children**

A large number of studies has shown that typically-developing children acquiring English or Dutch can easily reject sentences in an experimental setting that requires the non-local interpretation of a reflexive, as in (2a), by the age of 4 years, whereas they fail to reject sentences that require the local interpretation of a pronoun, such as (2b) until the age of approximately 6 years (Chien & Wexler, 1990; Grodzinsky & Reinhart, 1993, Philip & Coopmans, 1996; Thornton & Wexler, 1999, among others). This asymmetry between the two principles of Binding Theory – that is, the early acquisition of Principle A and the delayed acquisition of Principle B in TD children – has been known as the Delay of Principle B Effect (DPBE) (see Thornton & Wexler, 1999, for an overview).

At the same time when TD children have difficulties in rejecting the local interpretation of pronouns, their performance increases considerably in contexts with quantificational antecedents, as in (3).

(3) Goldilocks<sub>i</sub> said that every bear<sub>j</sub> is washing her<sub>i/\*j</sub>.

This distinct performance between referential and quantificational NPs as antecedents has been explained by attributing the difficulties in rejecting the local interpretation of pronouns to extra-syntactic operations not related to problems with Binding Theory. In the contexts with quantificational NPs, the anaphoric relation between the pronoun and its antecedent cannot be that of co-reference, as quantificational NPs lack inherent reference. Instead, in contexts with quantificational NPs, pronouns are interpreted as bound variables (Grodzinsky & Reinhart, 1993; Thornton & Wexler, 1999).

To capture this distinction between binding and co-reference, Chien and Wexler (1990) propose that children's early grammars do not lack Principle B of Binding Theory, which is considered to be innate; rather, children have problems with a pragmatic principle (called Principle P) that rules out co-reference between two NPs that bear different indices, such as those under (2b).

In the framework of Reinhart and Reuland (1993), co-reference between a pronoun and a referential NP is not constrained by syntax proper, as referential pronouns are not bound variables. Co-reference relies on an extra-linguistic constraint outside syntax proper, formulated as Rule I (Grodzinsky & Reinhart, 1993). Syntactic binding applies to bound variable anaphora only (reflexives and pronouns in quantificational contexts) and is regulated by the reflexivity of predicates and the formation of syntactic chains. In this account, errors with pronouns in referential contexts are attributed to working memory limitations, because

in these contexts children need to build up both interpretations (binding and co-reference) and hold them in their working memory, before they can decide which interpretation is allowed (Grodzinsky & Reinhart, 1993). Due to immature working memory, children sometimes fail to keep both interpretations in working memory, and this is why they result in a guessing strategy whereby they accept a local antecedent.

In contrast to the reported difficulties with the interpretation of anaphoric expressions, corpus studies have shown that pronouns and reflexives are produced from early on (2;3-3;0), and by the age of 4;6 in a target-like manner, by TD English- and Dutch-speaking children (Blom, Barss, Nicol, & Conway, 1994; de Villiers, Cahillane, & Altreuter, 2006, Matthews, Lieven, Theakston, & Tomasello, 2009, for English; Spenader, Smits, & Hendriks, 2009, for Dutch), which is well before they can comprehend these elements in an adult-like manner. This finding gives rise to an interesting opposite-than-expected asymmetry between production and comprehension (Hendriks & Koster, 2010).

Despite the robustness of DPBE in languages such as English or Dutch, studies with languages distinguishing between clitics and strong pronouns have reported lack of DPBE in TD children acquiring Spanish (Baauw & Cueto, 2003; Baauw, Escobar, & Philip 1997), Italian (McKee, 1992) and Greek (Varlokosta, 2000). The non-vulnerability of clitic pronouns to DPBE in Romance languages and in Greek has been attributed to their morpho-syntactic make-up and to their non-canonical derivation in argument position compared to other pronominal or lexical noun phrases (Baauw, 2002; Déchaine & Wiltschko, 2002). Across languages, clitics are deficient morpho-phonological forms that cliticise on a verbal host, cannot be conjoined or stressed, and merely spell out the phi-features (gender, number and person) of their referent and fulfil the case requirements of their verbal host, as examples (1a) and (1b) indicate (see Mavrogiorgos, 2010, for a comprehensive overview). Clitics are impoverished structures that are underspecified for features such as [+/- human] (Baauw,



2002) and [Animacy] (Jakubowicz, Nash, Rigaut, & Gerard, 1998), although they can refer to non-human antecedents, contrary to strong pronouns in English or in Dutch. This internal deficiency affects their external distribution and interpretation. Clitics do not appear in canonical argument positions, but cliticise pre-verbally on finite verbal hosts. According to Baauw et al.'s (1997) view on the lack of DPBE in clitic languages, clitics can only function as bound variables due to their impoverished internal structure; they need to be referentially bound to an antecedent to recover their morpho-syntactic and semantic features. As a result, co-reference is excluded in clitic contexts, and clitics are subject only to syntactic binding (Baauw et al., 1997).

Despite the lack of DPBE in clitic languages, production of clitics in TD children has been shown to be more or less vulnerable depending on target language properties (e.g., see Gavarró, Torrens, & Wexler, 2010). However, this issue remains controversial and results depend on the methodology used (elicitation vs. spontaneous data), as well as on how appropriate clitic production is calculated, and whether correct suppliance is considered more important than types of errors, such as omissions or substitutions.

The question that arises at this point is whether children with neurodevelopmental disorders exhibit the same production and comprehension patterns as those observed in TD children. A performance that is similar to younger TD children in terms of accuracy or error types would suggest that children with language impairment exhibit a delayed acquisition profile. In contrast, if we observe performance patterns in children with affected language that have not been reported for typical populations, then it would be possible to argue for deviant performance. As Rice et al. (2005) note, the distinction between 'delay' and 'deviance' is important, as it will unravel whether or not the linguistic and neurocognitive systems of affected and unaffected children are the same or different. In the next section, we

review the studies on the production and interpretation of anaphoric expressions in children and adolescents with neurodevelopmental disorders.

### **3. Acquisition of pronouns and reflexives in atypical populations**

Despite the extensive literature on the acquisition of reflexives and pronouns in TD children, the acquisition of these structures has received less, yet recently increasing, attention in children with neurodevelopmental disorders such as SLI, ASD, WS and DS. In addition, the studies that investigate a specific grammatical phenomenon across populations remain few (Perovic, Modyanova, & Wexler, 2013; Ring & Clahsen, 2005).

SLI is a neurodevelopmental disorder that affects primarily language, and children with SLI perform below age expected norms on language measures (Leonard, 1997; Schwartz, 2009). Compromised language abilities are observed in the absence of general cognitive abilities, hearing impairment, frank neurological impairment, psycho-emotional disturbance, and comorbidity with other disorders such as ASD. The linguistic abilities of children with SLI have been shown to be compromised in the domain of grammatical morphology, such as tense in English (Rice & Wexler, 2001), and complex structures such as *wh*-questions (e.g., Friedmann & Novogrodsky, 2004). Children with SLI have also been reported to have problems with phonological working memory (Gathercole & Baddeley, 1990), as well as with vocabulary and lexical organization (Sheng & McGregor, 2010) among other things.

Autism is a complex neurodevelopmental disorder classified primarily on the basis of deficits in the areas of communication, social interaction and repetitive and stereotyped behaviour (Hulme & Snowling, 2009). The term ‘spectrum’ highlights the heterogeneity of

verbal and non-verbal characteristics within this syndrome. Individuals with ASD range from low to high IQ, and exhibit a mixed profile in terms of language abilities. Whereas deficits in the domain of pragmatics are considered to be universal (Tager-Flusberg, 1999), the investigation of syntactic abilities has provided mixed results. Roberts, Rice and Tager-Flusberg (2004) and Kjelgaard and Tager-Flusberg (2001) reported compromised language abilities even in the absence of intellectual impairment, and proposed a language phenotype in ASD similar to that of SLI (especially due to problems with tense and non-word repetition). Given the heterogeneity of verbal abilities in ASD, the current literature adopts an important distinction between children with ASD with language impairment and children with ASD with preserved language abilities, as these two groups seem to have different linguistic profiles (Kjelgaard & Tager-Flusberg, 2001).

WS is a rare (1 in 25,000) genetically-based neurodevelopmental disorder which involves the deletion of contiguous genes on chromosome 7 (Korenberg, Chen, Hirota, Lai, Bellugi, Burian, Roe, & Matsuoka, 2000). Children with WS have mild to moderate mental retardation (average IQ of around 50 which rarely exceeds 80) and are known for a profound delay in visuospatial reasoning (Bellugi, Bihle, Neville, Jernigan, & Doherty, 1992). However, their expressive language abilities are considered to be rather well preserved (Bellugi et al., 1992; Clahsen & Almazan, 1998; but see Perovic & Wexler, 2007, on compromised comprehension abilities in Williams syndrome). In addition, individuals with WS exhibit an extremely social / outgoing personality (Bellugi et al., 2000), contrary to individuals with ASD.

A syndrome which is considered particularly detrimental to language development is DS, a neurodevelopmental disorder caused by an abnormality (extra copy) in chromosome 21. Individuals with DS have a moderate to severe mental retardation, and their language abilities are even more compromised than their cognitive abilities (Tager-Flusberg, 1999),

with morpho-syntax being more impaired than vocabulary (e.g., Miller, 1988). In a series of studies, Bellugi and colleagues have shown that individuals with WS outperform those with DS on language skills, even when the groups are matched on chronological age and non-verbal abilities (e.g., Reilly, Losh, Bellugi, & Wulfeck, 2004).

### *3.1 Production of pronouns and reflexives in atypical populations*

Studies examining the production of strong pronouns and reflexives in children with SLI in the context of a narrative have reported no problems in the use of pronouns and reflexives for discourse maintenance and character introduction (e.g., van der Lely, 1997), suggesting that production of anaphoric expression in children with SLI is age-appropriate. When children with SLI were compared to age-matched children with WS (Reilly et al., 2004), a dissociation was found between the development of morpho-syntax and the use of linguistic forms to convey and integrate thematic content. Whereas children with SLI initially used fewer devices than their TD age-matched controls to convey thematic content, they managed to later catch up and could felicitously refer to characters and story content. Children with WS, however, lagged behind in this respect.

Studies with individuals with ASD have provided mixed results. An early finding was that ASD children exhibit what is called *pronoun reversal*, that is they interpret *you* as *I* and vice versa (Lee, Hobson, & Chiat, 1994). Higher production of ambiguous referential expressions than their TD peers was corroborated in a study with two groups of high-functioning children and adolescents with autism aged between 5 and 14 years (Novogrodsky, 2013). This finding differed from those of Tager-Flusberg (1995) and Arnold, Bennetto, and Diehl (2009), who reported no differences in terms of the referential use of pronouns between adolescents with ASD and their language- and age-matched peers.

The above studies point towards disparities between syntactic and pragmatic deficits within different clinical populations. It appears that in children with SLI pragmatic difficulties may be secondary to their grammatical abilities; in children with primarily pragmatic abilities, such as children with WS and ASD, difficulties with the use of anaphoric devices may exceed syntax proper, although more research is needed.

### *3.2 Clitics as clinical markers*

In languages with a distinction between clitics and strong pronouns, production of clitics has been reported to be problematic in children with neurodevelopmental disorders. To our knowledge, the overwhelming majority of these studies is on children with SLI, whereas studies with other disorders are quite scarce (Tuller, Delage, Monjauze, Piller, & Barthez, 2011; Terzi, Marinis, Kotsopoulou, & Francis, 2014). These studies have shown that children with SLI have more problems with direct object clitics than with other nominal elements, such as definite articles, which are morpho-phonologically similar, or with other types of clitics, such as subject clitics. The vulnerability of clitics in children with SLI has been attested in a number of languages, such as Spanish (Bedore & Leonard, 2001, among others), Italian (Bortolini, Caselli, Deevy, & Leonard, 2002; Cipriani, Bottari, Chilosi, & Pfanner, 1998), French (Jakubowicz et al., 1998; Jakubowicz & Nash, in press) and Greek (Tsimpli & Stavrakaki, 1999, among others). This has led to the characterisation of clitics in certain languages as clinical markers for SLI (Italian, French), similar to tense marking in English (Rice & Wexler, 2001). However, the degree and perseverance of difficulties may vary across languages and studies depending on the type of data (spontaneous or experimental).

The majority of experimental studies have adopted versions of a production task developed by Schaeffer (2000) and Jakubowicz et al. (1998) to elicit clitics. In this task, two

entities (X and Y) are initially introduced into discourse usually accompanied by pictures or props. Then the experimenter asks the question *What is X doing to/with Y?*. The child is expected to refer to at least one of the two potential discourse antecedents with a clitic, as in (4) below:

(4) Experimenter: *Que fait le garçon avec le gateau?*

‘What is the boy doing with the cake?’

Child (expected answer): *Il le.CL mange.*

‘He is eating it.’

Cross-linguistically, these studies have shown that children with SLI either produced full lexical NPs instead of clitics or omitted the clitic.<sup>2</sup> However, the proportion of omissions and substitutions differs across languages.

Using this type of task, Jakubowicz et al. (1998) and Jakubowicz and Nash (in press) examined the production of reflexives and accusative clitics in different age groups of 5- to 13-year-old children with SLI. These studies showed that performance on reflexives was higher than on accusative clitics, whose production was optional even at the age of 13 years. This finding led to the characterisation of clitics as clinical markers in French, which has been supported in a number of spontaneous and experimental studies (see Prévost, 2009, for an overview).

The status of clitics as clinical markers is more controversial in languages such as Greek (e.g., Manika, Varlokosta, & Wexler, 2011). Stavrakaki and van der Lely (2010) examined the production of strong and clitic pronouns in a group of nine 10-year-old Greek-

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<sup>2</sup> Substitution of the clitic with a full lexical NP is considered infelicitous but not ungrammatical in this context. Clitic omission is ungrammatical in this context.

speaking children with SLI. Children with SLI exhibited low accuracy on the production of clitics (5.22 out of 8 items) in contrast to the ceiling accuracy on strong pronouns and reflexives.

Problems with direct object clitics were also reported in the study by Chondrogianni, Marinis, Edwards, and Blom (2014) with 6- to 8-year-old children and their TD age-matched controls. In this study, the TD and the language-impaired children were tested on an elicited production task similar to that in (4) and an on-line processing task. The on-line processing task contained grammatical and ungrammatical sentences with and without definite articles and clitics, and examined children's sensitivity to grammatical violations induced by article or clitic omission. The children with SLI had higher accuracy (85%) than the ones reported in the Stavrakaki and van der Lely (2010) study; yet, they differed from their TD age-matched controls (accuracy: 95%). In the on-line processing task, children with SLI were not able to detect the grammatical violations related to the omission of clitics, although they were sensitive to the grammatical violations induced by the omission of definite articles.

The results from the studies mentioned above suggest that clitics have depressed performance in children with SLI compared to their TD controls, despite cross-linguistic differences in accuracy.

### *3.3 Why are clitics problematic in atypical acquisition?*

Given the linguistic nature of the impairment in children with SLI, most of the theoretical accounts of SLI attribute the vulnerability of clitics to their deficient morpho-syntactic properties or to the grammatical operations involved within a domain-specific view of grammatical impairment. However, the accounts differ as to whether they postulate representational or performance errors with clitics.

Representational problems are postulated by accounts that argue for a deficit at the level of syntactic operations, as suggested by the Representational Deficit for Dependent Relations (RDDR; van der Lely, 1998) and its successor, the Computational Grammatical Complexity Hypothesis (CGCH; van der Lely, 2005). According to the RDDR and the CGCH, syntactic operations (e.g., *Move*) which involve displacement of constituents from their original position to another position in the sentence as well as the formation of Argument-chains (A-chains) between the moved constituent and its trace/antecedent, are optional in children with SLI. Children with SLI are expected to optionally produce clitics because clitics constitute displaced constituents that form A-chains with their antecedents.

Representational problems have also been postulated at the level of uninterpretable features by the Interpretability Hypothesis (Tsimpili & Stavrakaki, 1999). Uninterpretable features are grammatical features that bear no semantic content, such as the case or gender features that can be found on clitics. These features are inaccessible for children with SLI, who acquire them via a learning, rather than an acquisition, mechanism that requires longer and more strenuous exposure than in the case of typically-developing children. Accounts such as the Unique Checking Constraint (Wexler, 1998) postulate selected deficits in certain languages, but not in others, if SLI grammars are susceptible to maturational constraints also found in TD children. In contrast to these accounts, the Computational Complexity Hypothesis (CCH; Jakubowicz et al., 1998; Jakubowicz & Nash, in press) postulates no representational deficits. Instead, problems with clitics arise from their categorical deficiency that requires them to move and merge in an argumental position in a non-canonical way; the combination of these two operations (*Move*, *Merge*) is more costly than a simple *Merge*, following Chomsky (1995). It is this non-canonical movement that poses problems for children with SLI and not movement in general (contra van der Lely's CGCH account).



Importantly, problems with the production and/or comprehension of clitics cannot be merely attributed to their low phonetic salience, as postulated by domain-general theories such as the Surface Account (Montgomery & Leonard, 1998, 2006). This is because cross-linguistically clitics have been shown to have a distinct and more impaired acquisition pattern than the homophonous definite articles (Tsimpli & Stavrakaki, 1999, for Greek; Jakubowicz & Nash, *in press*, for French), as well as compared with other phonetically non-salient clitic types that do not have an argumental status (Stavrakaki & van der Lely, 2010).

It remains to be established whether these theoretical accounts of a particular language disorder that is primarily grammatical, such as SLI, can apply to other neurodevelopmental disorders, in which grammatical problems are not the core or the only deficit, and where the overlap with general cognitive deficiencies is more pervasive than in SLI. If we assume that some of the domain-specific accounts of SLI, such as the IH or the CCH, try to capture grammatical properties of clitics that are inherent to the linguistic system and not to a specific disorder, then we would expect to find problems with the same structure across disorders of different etiologies and genetic underpinnings. For example, Tuller et al. (2011) showed that third person direct object clitics are problematic not only in French-speaking children with SLI, but also in children with mild-to-moderate hearing loss, and in children with rolandic epilepsy. These are two disorders that do not involve any intellectual deficit, but involve late onset of speech and compromised language abilities, similar to children with SLI.

Interestingly, clitics were found to be problematic in a study examining comprehension and production of pronouns and reflexives in a group of 5- to 8-year-old Greek-speaking children with ASD (Terzi, Marinis, Francis, & Kotsopoulou, 2012; Terzi et al., 2014). These were all high-functioning ASD children with an IQ above 80 and without any vocabulary or general grammatical problems. Children were tested on the production task

from Chondrogianni et al. (2014). Children with ASD performed significantly worse than their age-matched controls on the production of clitics (87.4% vs. 97.7%), whereas both groups had ceiling accuracy on pronouns and reflexives.

Despite the striking similarity in clitic production between the Greek-speaking children with SLI and ASD of similar age reported in Chondrogianni et al. (2014) and in Terzi et al. (2014) respectively, it remains to be established whether the source of the difficulties in both affected populations is the morpho-syntactic complexity and deficiency of clitics, as it has been suggested for children with SLI, or whether it relates primarily to the pragmatic nature of clitics in children with ASD. As Roberts et al. (2004) note, symptomatic similarity is not definitive evidence because similar symptoms can arise for different reasons, and one needs to be cautious when interpreting performance on similar structures across disorders.

### *3.4 Is binding impaired in atypical populations?*

Turning to comprehension studies, the question that arises is whether problems in the comprehension of pronouns and reflexives are found in children with neurodevelopmental disorders acquiring languages where such problems have been reported in typical acquisition, as in English. Such studies are reviewed in this section. In the next section, we review whether problems with the comprehension of clitics and reflexives also emerge in languages where such problems have not been reported in typical acquisition.

The majority of the studies mentioned in this section have used a truth-value judgment task (TVJT), a sentence-picture matching task, or a binary picture selection task to examine whether children make binding errors. In a TVJT and a sentence-picture matching task, participants are asked to make a judgement about whether the sentence they hear

matches or mismatches the picture they see, as in examples (2a) and (2b). Alternatively, in a binary picture selection task, participants are presented with two pictures and they are asked to choose the one that corresponds to the sentence they heard.

Van der Lely and Stollwerk (1997) examined the acquisition of pronouns and reflexives in a group of 11-year-old children with SLI using two sentence-picture matching tasks. Experiment 1 tested simple clauses / questions similar to the ones in Chien and Wexler (1990), such as *This is Goldilocks. Is Mama bear washing her?*, while Experiment 2 tested bi-clausal sentences with intrasentential reference, such as the sentence in example (2b) mentioned previously. The experimental conditions involved pronouns and reflexives with referential and quantificational antecedents in match and mismatch conditions. The task also comprised control conditions that examined whether children with SLI were sensitive to lexico-semantic cues, such as semantic gender (*Peter Pan says that Wendy is washing him*).

Children with SLI performed at chance level on the mismatch conditions in simple questions and in bi-clausal sentences involving pronouns with referential NPs, and they had almost ceiling accuracy on the pronouns condition with quantificational NPs. Contrary to the TD controls, children with SLI performed at chance level on the sentences with reflexives with a quantificational NP antecedent in both the match and the mismatch conditions, and on sentences that examined sensitivity to locality violations associated with Principle A.

The van der Lely and Stollwerk (1997) study revealed two important findings. Firstly, children with SLI exhibited chance performance on sentences with reflexives with referential and quantificational NPs as antecedents; this is a pattern of performance that had never been reported in TD English-speaking children. Secondly, children with SLI can make use of lexico-semantic cues such as gender to assign interpretation to pronouns and reflexives, especially when the features on the two possible antecedents clash. However, when lexico-

semantic cues are not available to assign interpretation to pronouns and reflexives, and they need to rely on syntactic knowledge, then children with SLI perform at chance level.

Crucially, difficulties with the comprehension of reflexives but not with pronouns have also been reported in English-speaking children with ASD (Perovic, Modyanova, & Wexler, 2012, 2013) and DS (Perovic, 2006; Ring & Clahsen, 2005). Ring and Clahsen (2005) used van der Lely and Stollwerk's (1997) task to assess comprehension of pronouns and reflexives in a group of eight adolescents with DS and ten with WS matched on age and non-verbal IQ. The results from the DS individuals in their study are in line with those of Perovic (2006) who had fewer participants and who used a different methodology in her study. Adolescents with DS exhibited marked difficulties with the comprehension of reflexives with a referential and a quantificational NP in both the match and the mismatch conditions compared to the mental age-matched controls. This contrasted with the performance of the WS individuals, who exhibited no problems with reflexives or with pronouns. At the same time, adolescents with DS exhibited almost error-free performance on pronouns. The results from the children with DS and with WS who were matched on non-verbal abilities seem to suggest that performance on binding is independent of general cognitive abilities in these two populations.

The interplay between general cognitive abilities and specific grammatical properties becomes less clear in children with ASD due to the heterogeneity of the disorder. Perovic et al. (2012, 2013) studied the acquisition of Binding Principles A and B using a binary picture selection task (Chien & Wexler, 1990) in a group of children and adolescents with ASD aged between 6;6 and 17 years old (mean age: 11;6). Possessive noun phrases (e.g., *Bart's dad*) served as potential antecedents in the reflexive and the pronoun experimental conditions. In a possessive construction, the child has the choice of two local antecedents, one c-commanding the dependent and the other not (*Bart's<sub>i</sub> dad<sub>j</sub> is pointing to him<sub>i/\*j</sub>/himself<sub>\*i/j</sub>*).

In both studies, the children with ASD with low non-verbal abilities and with language impairment (ALI group) performed at chance level on the interpretation of reflexives and better on pronouns. In contrast, in Perovic et al. (2013), the children with ASD with normal language abilities (ALN), the TD children, and a group of WS children who were age-matched with the ALI group, performed worse on pronouns compared to reflexives and the other control conditions. It is important to note that the WS children were matched with the ALI children on both age and verbal abilities.

### *3.5 Are there binding problems in children with atypical development acquiring clitic languages?*

Studies on typically-developing children acquiring clitic languages have shown that there is no delay of Principle B (e.g., Baauw et al., 1997; McKee, 1992; Varlokosta, 2000). However, the results from the language-impaired populations are mixed. Additionally, an important methodological caveat is at stake. Studies on clitic languages have primarily used picture selection tasks where participants are provided not only with a binding error, but also with a thematic role reversal error. In this experimental set-up, participants listen to a sentence with a clitic, as in (5), and see three pictures: (i) the target picture, e.g., mum washing the girl, (ii) a picture with a binding error, e.g., mum washing herself, and (iii) a thematic role reversal error, e.g., the girl is washing mum.

(5) I    mama   tin        pleni.        (Greek)

La   mère   la        lave.        (French)

the   mum   her.CL   wash.3SG

‘Mum is washing her’

In this respect, the children in the studies on clitics are not presented with the same conceptual and methodological task as the children in the studies on strong pronouns, who need to make a judgment about the truth-value of a sentence and reject binding errors only. With this in mind, we review the studies on the comprehension of clitics and reflexives in children with language impairment.

Jakubowicz et al. (1998) and Jakubowicz and Nash (in press) examined comprehension of reflexive and accusative clitics in the same children with SLI mentioned previously in the context of a production study. The comprehension task comprised picture triplets like the one mentioned above. The children with SLI showed better performance on reflexive than on accusative clitics. However, neither types of clitics reached age-appropriate accuracy in the language impaired group.

In terms of error types in the comprehension of accusative clitics, Jakubowicz and Nash (in press) reported that reversal errors were more frequent than binding errors for all groups of SLI children. In terms of error types with reflexives, the 5-year-old children with SLI had more binding (30%) than reversal errors (10%).<sup>3</sup> The results from these two studies show that reflexive clitics and not only accusative clitics are problematic in children with SLI. They also demonstrate that children with SLI make binding errors both with pronouns and reflexives.

The comprehension of clitics and reflexives has received renewed interest in Greek-speaking children with different language disorders. Stavrakaki and van der Lely (2010) examined the comprehension of strong and clitic pronouns in the same group of 10-year-old Greek-speaking children with SLI as in the production study mentioned previously. They

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<sup>3</sup> It should be noted that Jakubowicz and Nash (in press) focused primarily on accusative object clitics and reported primarily accuracy scores on the comprehension of pronouns without providing detailed results on the different error types or on the (mis)match conditions. It is, thus, difficult to evaluate children's performance on reflexives apart from what the authors briefly report.

used a comprehension task similar to that of Jakubowicz and Nash (in press) plus a semantic distractor that depicted a different action from the one denoted by the target verb. The task examined strong, clitic and reflexive pronouns in simple direct object contexts.<sup>4</sup> Greek-speaking children with SLI showed chance performance on the comprehension of clitics, in contrast to almost ceiling comprehension of strong pronouns and reflexives. In terms of errors, the children with SLI had significantly more reversal errors than the language-matched children, and assigned a reflexive interpretation more often than the language-matched children.

Varlokosta and Nerantzini's (2012) study is the only one currently to report problems with clitics in complex but not in simple sentences, as well as problems with reflexives, in Greek-speaking children with SLI. Children with SLI were compared to two groups of age-matched (mean age: 5;9) and language-matched (mean age: 4;7) children using a binary picture-selection task. Clitics and reflexives appeared in simple, quantified, and complex constructions, where the entity denoted by the clitic was the object of the matrix verb and the subject of the embedded verb. Children with SLI had ceiling accuracy on clitics in simple (94%) but not in complex contexts (59%). They also exhibited lower performance on simple (79% accuracy) and quantified reflexives (76% accuracy) compared with the language- and age-matched controls, whose accuracy was between 87% and 95%, respectively. However, their accuracy differed from chance, contrary to what was reported for the English-speaking language-impaired children.

Problems with the comprehension of clitics but not with reflexives have been reported in another group of children with neurodevelopmental disorders. Terzi et al. (2012, 2014) tested the same high-functioning ASD children without any vocabulary or general

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<sup>4</sup> Stavrakaki and van der Lely (2010) also examined genitive clitics and clitics with anaphors. These results are not discussed here.

grammatical problems as mentioned previously. Children were tested on a comprehension task similar to that of Stavrakaki and van der Lely (2010) without the semantic distractor. Children with ASD showed reduced performance on the comprehension of clitics (88.3% accuracy) in comparison to the ceiling accuracy on strong pronouns and reflexives, and compared with the TD children who had ceiling performance across all conditions. The majority of errors consisted in reversal errors with very few binding errors.

Crucially, the studies by Varlokosta and Nerantzini (2012) and by Stavrakaki and van der Lely (2010) and Terzi et al. (2012, 2014) on the interpretation of clitic pronouns and reflexives in Greek-speaking children with SLI and ASD differ in a number of important ways. Varlokosta and Nerantzini (2012) used a binary picture-selection task similarly to the one used in languages with strong pronouns to test clitics in simple and complex contexts. Stavrakaki and van der Lely (2010) and Terzi et al. (2012, 2014) had picture selection tasks with four- and three-picture panels respectively. Additionally, it should be pointed out that the errors reported primarily in Terzi et al. (2012, 2014) are not binding errors, similar to those with clitics reported in Varlokosta and Nerantzini (2012) or in languages such as English (Perovic et al., 2013). The ASD children in these studies did not prefer the local interpretation of the clitic. They mostly preferred reversal errors. These errors may point towards language-impaired children failing to assign target thematic roles to the sentence constituents, and may indicate syntactic errors of a different nature to binding (e.g., Friedmann & Novogrodsky, 2004).<sup>5</sup>

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<sup>5</sup> It should be noted that Terzi et al. (2014) also administered a case task to check whether problems with clitics were related to problems with case. However, the task that they used tapped primarily into the morphological component of case by examining grammatical violations induced by case mismatch between the article and the noun, which both bear case in Greek, rather than examining whether or not children had knowledge of and were able to assign structural case. The fact that reversal errors were also found in the Jakubowicz and Nash (in press) study on French, which does not mark case overtly on nominal elements, suggests that problems with case cannot be merely morphological.



The results from the Terzi et al. (2014) study seem to converge on the finding that high-functioning children with ASD and without language impairment do not exhibit problems with reflexives, similar to the results reported in Perovic et al. (2013). Interestingly, Terzi et al. (2014) examined the results from three ASD children in their sample with a performance IQ below 80 and low verbal abilities, and reported that two of these children performed worse on reflexives (9/18 items) (and on all other conditions) than the high functioning ASD and TD children in their study.

The interplay between (low) cognitive abilities and binding was highlighted in a study by Stathopoulou (2009) with Greek-speaking children and adolescents with DS. The participants in her study had marked problems with both reflexives and pronouns, suggesting a link between cognition and binding in this population. Interestingly, problems with pronouns were overcome by a group of adults with DS reported in Sanoudaki and Varlokosta (2014), at the same time when problems with reflexives persisted.

Taken together, these results suggest that the interplay between general cognitive abilities and the interpretation of reflexives merits further investigation in children with ASD of different verbal and non-verbal abilities, as well as in children with other neurodevelopmental disorders.

### *3.6 Why is binding impaired in atypical populations?*

Van der Lely and Stollwerk (1997) argued that children with SLI have adequate knowledge of the conceptual lexical properties of pronouns and reflexives and theta role assignment to judge the sentence-picture pairs. However, the syntactic representations related to Binding Principles are underspecified in children with SLI according to the RDDR (van der Lely, 1998) and the CGCH (van der Lely, 2005). Children with SLI have problems with identifying

appropriate antecedents for reflexives and pronouns, when knowledge of the syntactic principle underlying binding is required. According to the CGCH, children with SLI have an underspecified grammar in terms of the obligatoriness of movement, and the formation of A-chains is optional in this population. This underspecified grammar leads to optionality at the individual level; ten out of the twelve children with SLI in van den Lely and Stollwerk's (1997) study exhibited optionality at the individual level.

However, recent studies have argued for a dissociation between syntactic dependencies involving movement, such as *wh*-movement, and syntactic dependencies involved in binding in children with SLI, with binding being intact in the context of problems with *wh*-questions (Hestvik, Schwartz, Tornyo, Almodovar, Love, & Swinney, 2007; Novogrodsky & Friedmann, 2010).<sup>6</sup>

In search for a grammatical explanation for the performance of the children with DS, Ring and Clahsen (2005) attributed the problems with reflexives to difficulties in the formation of A-chains between the reflexive and its antecedent as postulated in the theoretical framework proposed by Reuland (2001). Ring and Clahsen (2005) argue that problems with A-chain formation in children with DS can further be seen in their performance on another structure that involves A-chains, namely passives, and that the same DS children who performed poorly on binding structures in their study also performed poorly on passives.

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<sup>6</sup> The study by Hestvik et al. (2007) was an on-line comprehension study that showed that children with SLI had similar sentence processing patterns compared with the TD children, even though they were slower in terms of Reaction Times than their TD peers. Importantly, on-line comprehension studies with TD children (Bergmann, Paulus, & Fikkert, 2012) have shown that they are able to comprehend anaphoric expressions in real time at the age of 4 years, at the same age when they perform less well on off-line sentence-picture matching tasks. Furthermore, children with SLI have been shown to be unable to reanalyse the ambiguity created between the picture and the sentence in the mismatch conditions of the sentence-picture matching task even for simple transitive sentences (Marinis & Saddy, 2013). This suggests prominent processing problems in this population triggered by sentence-picture matching tasks.

Contrary to Ring and Clahsen (2005), Perovic et al. (2013) argue that problems with reflexives and passives in children with ASD cannot be reduced to a common deficit with A-chain formation. This is due to the finding that low-functioning ASD children have been reported not to comprehend passives at all (Tager-Flusberg, 1981), whereas they had chance performance on the comprehension of reflexives. Furthermore, reflexive binding is acquired much earlier in typically-developing children compared with the late acquisition of passives, which argues for a dissociation between the two grammatical operations in typical development as well. Instead, Perovic et al. (2013) propose that children with ASD do not have Principle A, which acts as a filter as to which constituent can act as an antecedent in a particular structure. This lack of filter makes both noun phrases potential antecedents and leads to chance performance (Perovic et al., 2013).

Interestingly, Terzi et al. (2014) also examined the acquisition of passives and reflexive verbs with passive interpretation and reflexive pronouns in the same group of high-functioning Greek-speaking children with ASD and found ceiling performance with reflexives and with reflexive verbs with a passive interpretation. At the same time, children with ASD and TD children performed less well on passive verbs. These results suggest that A-chain formation in passives may be different from that postulated for reflexives, and the two grammatical processes may indeed be independent in language acquisition terms, as suggested in Perovic et al. (2013).

Despite the number of emerging studies examining binding in different disorders, the available data are far from sufficient to draw any generalisations regarding the nature of the impairment within this particular domain of grammar. Evidence regarding the presence or absence of problems with reflexives comes from studies that either differ in the nature of reflexive pronouns (e.g., English vs. Greek), or in the type of impairment investigated (e.g., SLI vs. autism vs. DS) or there is diversity within the groups with the same disorder (e.g.,

high- vs. low-functioning children with ASD). The majority of these studies also employ different methodologies (e.g., truth-value judgment task, picture selection task with different numbers of pictures and with possible errors) and experimental conditions of different complexity, which makes them very hard to compare given the potential of task effects.

#### **4. Conclusions and future directions**

The present chapter set out to evaluate experimental studies on the production and interpretation of pronouns and reflexives across different clinical conditions in an attempt to unravel similarities and differences in disorders that have different etiologies and genetic underpinnings, but which may exhibit overlapping linguistic phenotypes. Similarities across different disorders may help us better understand the nature of the language faculty and the vulnerability of the linguistic system under conditions of atypical development. Differences across populations can highlight the relative contribution of other factors to language impairment, such as general cognition and age.

The review of the literature revealed two important findings. Firstly, children and adolescents with different neurodevelopmental disorders exhibit both delayed and deviant patterns of performance in terms of the production and interpretation of anaphoric expressions. Secondly, the existing studies are too few to allow us to disentangle the interplay between different components of the language faculty and cognition across neurodevelopmental disorders.

In children with SLI, a delay was observed in the production of clitics but not strong pronouns. This seems to be a common finding across languages and renders the potential for the clinical status of clitics even stronger. The extent to which clitics are problematic in other

populations with language impairment remains to be investigated, as currently there are too few studies to draw any generalisations. The few available studies seem to indicate that clitics may be problematic in other populations as well, such as in Greek-speaking children with ASD or French-speaking children with mild-to-moderate hearing loss. However, the extent to which difficulties with clitics lie within the linguistic system itself or are related to the implementation of grammatical knowledge due to a pragmatic impairment is open to further research. Theoretical and clinical research will benefit from studies that try to disentangle these factors.

Perhaps the most significant finding is that across disorders children exhibited an impaired comprehension of reflexive pronouns. This was attested in Greek- and English-speaking children and adolescents with SLI and DS and in English-speaking children with ASD with language impairment. This is a deviant pattern of performance not previously attested in TD children. The various accounts within the neurodevelopmental disorders try to capture this deviant performance by postulating a breakdown of core grammatical operations and principles (movement, A-chains, Principle A). Importantly, problems with reflexives were only attested in the ASD children who also had low non-verbal abilities, but not in ASD children with unaffected verbal and non-verbal abilities (Perovic et al., 2013; Terzi et al., 2014). Whereas the results from the ASD children point towards an interplay between general cognition and a very specific grammatical component, the fact that binding is problematic in populations with unaffected cognitive abilities (children with SLI) as well as in populations with very compromised cognitive abilities (individuals with DS) renders the relationship between cognition and language abilities less clear.

Future research would need to disentangle the interplay between (low) non-verbal abilities, age and performance on pronouns and reflexives across languages and neurodevelopmental disorders with diverse neurocognitive profiles. Finally, methodological

considerations, and crucially, the type of task and the experimental set-up are of critical importance. The review of the literature revealed that most studies differ in this respect. As a result, comparability of findings and understanding of what may be a task effect or a window into the underlying grammatical nature of the disorder becomes less straightforward.

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